SECTION 511.00 – SUBGRADE SEPARATION AND FILTRATION

SECTION 511.00 – SUBGRADE SEPARATION AND FILTRATION

One mode of failure in pavements is pumping of the subgrade into the base, weakening the structure and leading to excessive deflection and fatigue failure and / or subgrade rutting.

To minimize the potential for pumping, a separator must be placed between the base and any subgrade soil, which can infiltrate the base. The separator may be a graded filter, sand blanket or geotextile. Geotextiles are currently the most common separators used. Like a filter, the geotextile must allow water to pass through but retain the subgrade soil particles without plugging. See Standard Specification Subsection 718 for geotextile properties.

Soils which need separation and filtration in almost all conditions are: silts, sandy and clayey silts, and silty to clayey fine sands. Non-plastic silts and silty fine sands exhibit the most potential for pumping. If the base course placed over these soils does not meet the filter criteria shown below for the subgrade soil, a geotextile separator / filter is needed.

D_{15} (filter) / D_{85} (soil) < 4 to 5 < D_{15} (filter) / D_{15} (soil)

The grain diameter (D) is in mm. D_{15} for example is the diameter of the soil particle for which 15% of the material is smaller.

The U.S. Army Corps of Engineers added another criterion to produce gradation curves for the soil and filter which are somewhat parallel.

D_{50} (filter) / D_{50} (soil) ≤ 25

When the subgrade soil contains appreciable gravel, base the filtration criteria on the portion of the soil finer than the 1 inch (25mm) sieve.

For highly plastic clays, a base or subbase material with at least 15% finer than the 0.4 mm (#40) sieve will often provide adequate filtration. Geotextile separators may still provide a benefit in reducing the potential for heaving of the subgrade.

The soils which are the most moisture sensitive and should be separated by a geotextile in almost all circumstances will typically have more than 50% finer than the 0.074 mm (#200) sieve and Plastic Indices greater than 10%. The most unstable soils will show a severe drop in R-value with very small increases in moisture content above optimum, and in some cases at or very near optimum.

Rock Cap will require a geotextile separator in nearly all cases. If Rock Cap is to be placed on granular subbase or on shot rock embankment, check the filter requirements to see if the geotextile is needed. The open graded nature of the Rock Cap will allow infiltration of most all subgrade soils, and a geotextile separator is needed.

A slit film woven geotextile will usually be satisfactory over most subgrade soils where groundwater is **not** present and the moisture entering the pavement structure is due to surface infiltration only. Where ground water **is** present within a depth where capillary action will draw moisture into the subgrade, a separation geotextile with the filtration and permeability properties of a drainage geotextile should be used. The Apparent Opening Size (AOS) and Permittivity should be selected to adequately filter the subgrade soil and provide at least ten times the permeability of the subgrade soil. A non-woven geotextile is typically necessary to meet the filtration and drainage requirements. Monofiliment woven geotextiles may be used in a filtration capacity. However, the minimum open area must be at least 4%.

511.01 References.

Seepage Drainage and Flow Nets, H. Cedergren, John Wiley and Sons, 1968.

Geotextile Engineering Manual, STS Consultants, FHWA, National Highway Institute, 1985 and later editions.